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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/613,513	07/03/2003	Brian Y. Lim	ATOMP001	4790

51111 7590 02/04/2010

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ART UNIT	PAPER NUMBER
3742	

NOTIFICATION DATE	DELIVERY MODE
02/04/2010	ELECTRONIC

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/613,513
Filing Date: July 03, 2003
Appellant(s): LIM ET AL.

Melvin D. Chan
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900 Lafayette Street, Suite 710
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For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 11/5/09 appealing from the Office action mailed 3/20/09.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows: The double patenting rejection has been withdrawn in view of the abandonment of 10/613,217, that is, it is no longer pending.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,756,026	Colbert et al.	6-2004
WO 02/081366	Dai et al.	10-2002
6,801,350	Glaser-Inbari et al.	10-2004
2002/0127170A1	Hong et al.	9-2002
6,683,783	Smalley et al.	1-2004

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 112

Claim 8 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 8 states “a set of islands of catalyst”; it is not clear how a set of islands of catalyst can be associated with one die. Is the die very large, are the catalyst areas scattered about?

Claim 9 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 9 states “all catalyst throughout die”. Is the catalyst on, in or near the die(s)? The independent claim refers to dies, while claim 9 discloses a die.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3, 6-7, 9, 11-14 &18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Colbert et al. (US Pat. 6,756,026) in view of Dai et al. (WO 02/081366A1).

Colbert et al. discloses a system in which nanocomponents for nanodevices are made. The system has a mounting element such as a precision translation stage(s) having movement capabilities in the XYZ directions. Mounting requires a minimum of two precision stages. Carbon feedstock gas may be added into the reactor. A catalyst may be formed in-situ using temperatures of 400 to 2000 C. Heat can be supplied in a locally using a laser (e.g. argon), microwave energy, or R-F energy.

Colbert et al. does not teach multiple radiating energy beams (prongs).

Dai et al. discloses an apparatus for the manufacture of carbon nanotubes. The system has substrate which supports nanotube growth (catalyst coated substrates); a localized heating zone within the reaction chamber and gaseous carbonaceous feedstock is feed into the chamber. Suitable heating means include resistant wires, induction field, microwave radiation or infrared radiation. The localized heating zone can also be heated from a remote point by, for example a focused infrared beam or laser

beam. Temperatures range from 300 to 800ºC. Localized heating zones (8) have multiple prongs, as shown in figure 1B below:

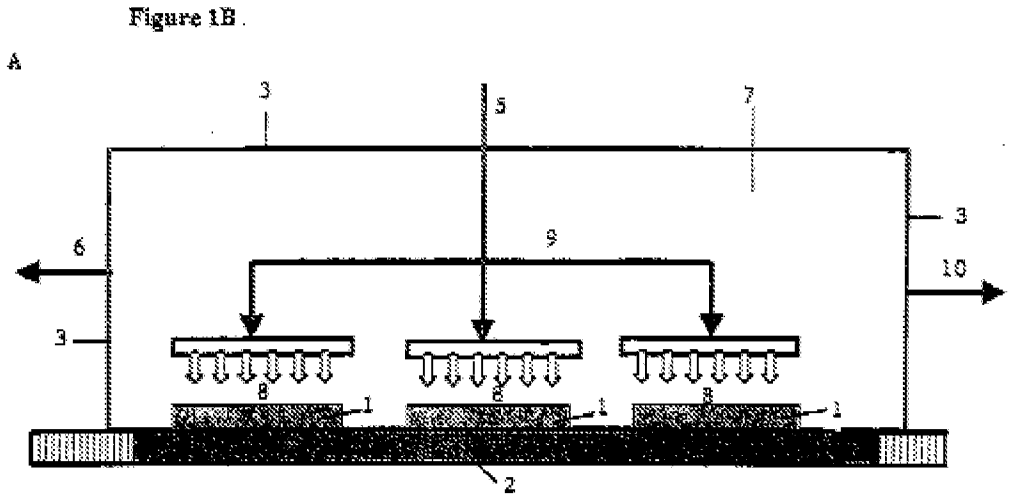

Figure 1B Dai et al. (WO 02/081366A1) shows localized heating zones (8) with multiple heating prongs or laser beam prongs.

It would have obvious to one of ordinary skill in the art at the time of the invention to modify Colbert et al. to use multiple prongs for heating as taught by Dai et al. because it ensures even heating and hence uniform nanotube formation.

Claims 4-5 & 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Colbert et al. and Dai et al., as stated above and further in view of Glaser-Inbari et al. (USPN 6,801,350).

Although multiple prongs, i.e. multiple laser beams are taught, an actual beam splitter is not taught.

Glaser-Inbari et al. discloses in FIG. 14, the incoming beam is split into three parts (in an actual embodiment, the number of beams is likely to be larger. FIG. 14 shows only three beams for the sake of clarity). These beams (depicted in FIG. 14 in shades of gray for clarity, though in an actual system they all would have about the same intensity) enter beamsplitter 31, scanner 70, and so on. Because each of the beams has a slightly different angle, they are focused at slightly different locations on the data surface of the disk 24. In practice, **any number of beams, from two to over one hundred, may be used.**

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Colbert et al. and Dai et al. to use a beam splitter to form multiple beams because this is a common device used in laser systems for forms multiple beams.

Claims 15-17 & 29-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Colbert et al. and Dai et al., as stated above and further in view of Hong et al. (USPAP 2002/0127170).

Although the system is used for carbon nanotube fabrication and temperature is disclosed, temperature control is not specifically taught.

Hong et al. discloses an apparatus for fabricating nanotubes on workpieces including a stage for supporting a workpiece, a radiating energy source such as a laser system that emits laser beams that can heat a work region of the workpiece without heating another work region of the workpiece, and a feedstock delivery system. The

feedstock delivery system has a temperature controller 500 connected to the gas feed line to maintain a temperature such that a catalyst precursor can be injected in gas phase

It would have been obvious to one skilled in the art to use feedstock gas delivery line temperature controller 500 of Hong et al. because this temperature level is critical to the reaction and hence it is required that if be controlled.

Claims 47-49 & 52-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Colbert et al., Dai et al., and Hong et al. as stated above and further in view of Glaser-Inbari et al.

Although multiple prongs, i.e. multiple laser beams are taught, an actual beam splitter is not taught.

Glaser-Inbari et al. discloses in FIG. 14, the incoming beam is split into three parts (in an actual embodiment, the number of beams is likely to be larger. FIG. 14 shows only three beams for the sake of clarity). These beams (depicted in FIG. 14 in shades of gray for clarity, though in an actual system they all would have about the same intensity) enter beamsplitter 31, scanner 70, and so on. Because each of the beams has a slightly different angle, they are focused at slightly different locations on the data surface of the disk 24. In practice, **any number of beams, from two to over one hundred, may be used.**

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Colbert et al., Dai et al. and Hong et al. to use a beam splitter to

form multiple beams because this is a common device used in laser systems for forms multiple beams.

Although Glaser-Inbari et al. notes that the beams may be at a slightly different angle, it is the position of the examiner that the beamsplitter assembly is capable of generating parallel beams, perpendicular and so forth.

Claims 50-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Colbert et al., Dai et al., and Hong et al. as stated above and further in view of Smalley et al. (USPN 6,683,783).

Although the formation of nanotubes is disclosed, the application of an electric/magnetic field is not taught.

Smalley et al. discloses carbon fiber formation (nanotubes) in which an electromagnetic field is applied to orient the nanotubes during growth.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use an electromagnetic field as taught by Smalley et al. in the Colbert et al. system because this orients the nanotubes, forming arrays.

(10) Response to Argument

I. Argument Against First Ground of Rejection.

Appellant argues that 112, second paragraph rejection should be withdrawn because one of skill in the art would understand that semiconductor fabrication involves

patterning regions (e.g. islands). The examiner respectfully disagrees because claim 1 states that each die has catalyst on it and having a catalyst cannot be a set of islands of catalyst (as stated in claim 8); it may be, however, be in the form of a set of islands. Hence the 112, second paragraph, indefinite rejection is sustained. Additionally, claim 9 states all catalyst throughout the die. It is not known how catalyst is present in the die, for example, is the catalyst present through the entire body of the die. Claim 1 states that the catalyst is present on the die and not throughout the die. Thus the 112, second paragraph indefinite rejection is sustained.

II. Argument Against Second Ground of Rejection.

The second ground of rejection (double patenting) has been withdrawn in view of the abandonment of the application (10/613,217) hence Appellant's argument is moot.

III. Argument Against Third Ground of Rejection.

Appellant argues that claims 1-3, 6-7, 9, 13-14 & 18 stand or fall together and claims 11-12 stand or fall together. The examiner respectfully disagrees because claims 11 and 12 depend on claim 1.

The Prior Art References Do Not Teach or Suggest Essential Claim Elements.

Appellant argues that claim 1 recites "multiple prongs of radiating energy" is not taught by Dai. The examiner respectfully disagrees because Colbert et al. discloses the formation of a carbon fiber using heat sources such as microwave energy, laser energy,

RF energy, heated gas, heated feed gas and so forth. Dai et al. discloses growing multiple nanotubes (carbon fibers) using heated zones (8) and feed gas (9). Thus the localized heating zones and the gas heat the substrates, in a radiating fashion, on which the nanotubes are formed (see figure IB below). Thus the feed gas "prongs" (9) passing through a heat zone (8) will form multiple prongs of radiating energy.

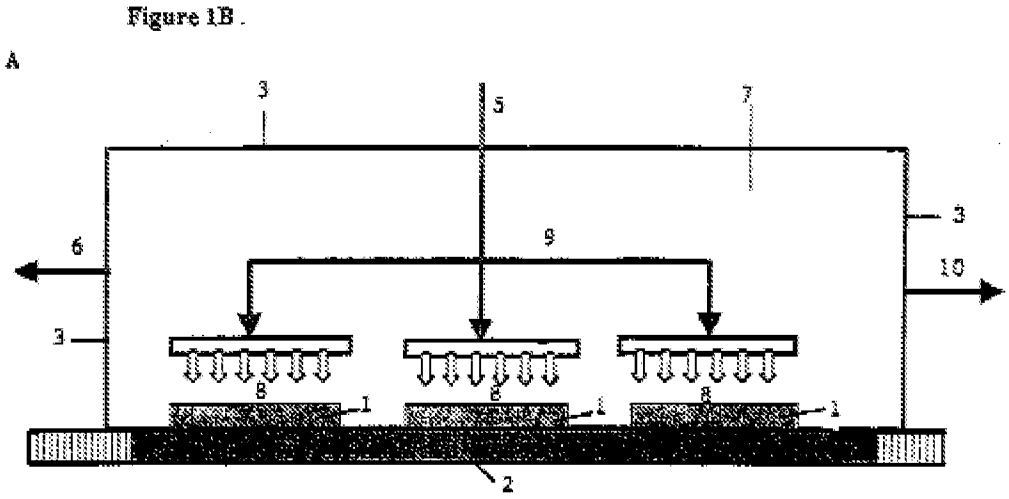

Figure 1B Dai et al. (WO 02/081366A1) shows localized heating zones (8) with multiple heating prongs or laser beam prongs.

Appellant argues that Colbert et al. would not apply multiple prongs or radiating energy because it would be against the Colbert's desire the only the heat supplied for the growth of the reaction should be focused on the growing tip of the fiber. The examiner respectfully notes that Colbert et al. discloses the growing of one carbon fiber while Dai et al. discloses the growth of multiple carbon nanotubes. It is the position of the examiner that if Colbert et al. grew more than one fiber there would have to be more than one heating source or supply. This is essentially the growth scenario in Dai et al.

whereby multiple carbon nanotubes are grown and require multiple radiating energy prongs as shown in the above figure 1B. Thus, the multiple radiating energy prongs would not be counter intuitive in Colbert et al. if more than one carbon fiber was grown.

Appellant argues that Dai et al. uses homogeneous heating and Colbert et al. uses heating of the fiber tip and hence are not combinable. The examiner respectfully disagrees because Dai et al. uses prongs of heat see above figure 1B. Furthermore, Colbert et al. is manufacturing only one carbon fiber while Dai et al. is manufacturing multiple carbon nanotubes (fibers). Thus Dai et al. would have to spread some of the heating out in the reactor in order that all the multiple carbon nanotubes are heated.

In response to appellant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, both Colbert et al. and Dai et al. are manufacturing carbon fiber(s). Colbert et al. is manufacturing a singular carbon fiber while Dai et al. is manufacturing multiple carbon nanotubes, however, both references are directed to the growth of carbon fiber(s).

Appellant argues that Colbert et al. and Dai et al. teach away from each other and one of ordinary skill in the art would not have modified Colbert et al. in view of Dai et al. The examiner respectfully disagrees because Colbert et al. is directed to one carbon fiber, while Dai et al. directed to multiple carbon nanotubes. It is the position of the examiner that Colbert et al. would use more than one heat source if more than one carbon fiber was manufactured.

Claims 11 & 12.

Appellant argues that the prior art does not teach that the feed stock delivery system is positionable at least in distance above the die and in direction of gas flow toward the die. The examiner respectfully disagrees because figure 1B (Dai et al.) above shows the substrates/dies and the gas above and directed towards the dies.

Appellant argues that the prior art does not teach the feed stock delivery system is positionable in the X, Y and Z directions. The examiner respectfully notes that the stages of Colbert et al. have movement capabilities in the X, Y, Z directions and hence the feed gas has relative motion with respect to the substrates.

IV. Argument Against Fourth Ground of Rejection.

Appellant argues that there is not articulated reasoning to support the conclusion of obviousness and that Colbert et al. and Dai et al. teach away from using multiple prongs of radiating energy and one of ordinary skill in the art would not include a beam splitter of Glaser-Inbari et al. to produce multiple prongs of radiating energy. The

examiner respectfully disagrees because Dai et al. teaches multiple prongs of radiating energy and Colbert et al. discloses heat sources such as microwave energy, laser energy, RF energy, heated gas, heated feed gas and so forth. Thus the multiple prongs of radiating energy of Dai et al. could be laser beams as taught by Colbert et al. Although Colbert et al. discloses the use of a laser beam and Dai et al. discloses multiple prongs of radiating energy there is no teaching of the formation of multiple laser beams; thus the need for Glaser-Inbari et al. Glaser-Inbari et al. discloses the splitting of a laser beam with a beam splitter to form multiple laser beams. Consequently, it would be obvious to use the laser beamsplitter of Glaser-Inbari et al. with Colbert et al. and Dai et al. to form multiple prongs of radiating energy, that is, multiple laser beams.

V. Argument Against Fifth Ground of Rejection.

Appellant argues that claims 15, 17, 29-36 & 39-46 stand or fall together and claim 16 stands or falls by itself, claim 37 stands or falls by itself and claim 38 stands or falls by itself. The examiner respectfully disagrees because claim 16 depends on claim 15, claim 37 depends on claim 29 and claim 38 depends on claim 29.

Appellant argues that the claims require a stage temperature control unit to control the temperature of the workpieces. The examiner respectfully notes that the control unit is coupled to the substrate and is helping to control the temperature of the workpiece. Dai et al. teaches substrate heating and the carbon nanotube fabrication is in a closed reactor. Colbert et al. teaches the use of a closed reactor i.e. isolated from

the ambient environment. Hong et al. discloses an apparatus for fabricating nanotubes on workpieces including a stage for supporting a workpiece, a radiating energy source such as a laser system that emits laser beams that can heat a work region of the workpiece without heating another work region of the workpiece, and a feedstock delivery system. The feedstock delivery system has a temperature controller 500 connected to the gas feed line to maintain a temperature such that a catalyst precursor can be injected in gas phase. Since all the carbon fiber/nanotube fabrication is conducted within a closed reactor it is the position of the examiner that the temperature control of the gas or the substrate will all yield a relatively constant workpiece temperature.

VI. Argument Against Sixth Ground of Rejection.

Appellant argues that there is not articulated reasoning to support the conclusion of obviousness and that Colbert et al. and Dai et al. teach away from using multiple prongs of radiating energy and one of ordinary skill in the art would not include a beam splitter of Glaser-Inbari et al. to produce multiple prongs of radiating energy. The examiner respectfully disagrees because Dai et al. teaches multiple prongs of radiating energy and Colbert et al. discloses heat sources such as microwave energy, laser energy, RF energy, heated gas, heated feed gas and so forth. Thus the multiple prongs of radiating energy of Dai et al. could be laser beams as taught by Colbert et al. Although Colbert et al. discloses the use of a laser beam and Dai et al. discloses multiple prongs of radiating energy there is no teaching of the formation of multiple laser

beams; thus the need for Glaser-Inbari et al. Glaser-Inbari et al. discloses the splitting of a laser beam with a beam splitter to form multiple laser beams. Consequently, it would be obvious to use the laser beamsplitter of Glaser-Inbari et al. with Colbert et al. and Dai et al. to form multiple prongs of radiating energy, that is, multiple laser beams.

VII. Argument Against Seventh Ground of Rejection.

Appellant argues that Smalley et al. does not teach an electric field influencing the direction of nanostructure growth in a selected work region. The examiner respectfully disagrees because Smalley et al. discloses:

> Macroscopic arrays can also be formed by providing a nanoscale microwell structure (e.g., a SiO.sub.2 coated silicon wafer with $>10^6$ rectangular 10 nm wide, 10 nm deep wells formed in the surface by electron beam lithographic techniques). A suitable catalyst metal cluster (or precursor) is deposited in each well and a carbon-containing feedstock is directed towards the array under growth conditions described below to initiate growth of SWNT fibers from the wells. Catalysts in the form of preformed nanoparticles (i.e., a few nanometers in diameter) as described in Dai et al., "Single-Wall Nanotubes Produced by Metal-Catalyzed Disproportionation of Carbon Monoxide," Chem. Phys. Lett. 260 (1996), 471-475 ("Dai") can also be used in the wells. An electric field can be applied to orient the fibers in a direction substantially perpendicular to the wafer surface. (col. 23, lines 1-17).

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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